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ABSTRACT

After considering various estimates of the extent to which there is a "literacy problem" in the United States, this paper develops an econometric model of the literacy program. Defining the volume of literacy as the total amount of information that people exchange through the materials they want or need to use, the volume of literacy is seen to be a function of people's reading ability, of the degree of comprehensibility with which materials are written, of the number of materials that people read, and of the number of people who do any amount of reading. The costs of producing that volume of literacy are determined by the same four variables. This model has many implications that are discussed in some detail, among them the fact that the most efficient use of educational resources would involve a balanced program of support for both reading and writing instruction. (AA)

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Literacy Policy and Reading and Writing Instruction

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Anyone who has been alive or even moderately alert for a couple of decades knows that society is periodically convulsed by literacy crises. In a cynic's view, these crises begin with some flimsey evidence purporting to show that people cannot read and write as well or as much as they ought and then develop into confused competitions over who gets to claim the blame and the spoils that go with it. Publishers, mindful of how government subsidies can increase profits, point out that people would read more if the prices of materials could be lowered. Librarians and booksellers, aware of their own incomes, join the chorus by pointing out that they could also make materials cheaper and more convenient for people to use. English teachers, who are in chronic oversupply, then weigh in with the observation that people could learn to write more comprehensibly than they do. And reading teachers with visions of higher salaries and larger reading clinics rend the public's heart with counts of all the little children who cannot recognize printed words much less comprehend what those words say. The public, despairing of making sense of the conflicting claims then seeks an obvious scapegoat, heaps its scorn and tax moneys on its head, and then forgets the matter only to discover a few years later that all we accomplished was to increase the costs of literacy a lot and the level of literacy very little. As we all know reading instruction usually claims the prize, although publishers do have their

second and fourth class mail subsidies and library incomes have outgrown not only inflation but also the population.[1]

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1 Data appearing in R. R. Bowker's Directory of American Libraries show that the total incomes of public libraries in the United States rose, in terms of 1976 dollars, from $2.47 to $4.36 per person, at a compound annual rate of 2.3 percent, between 1950 and 1975.

A cynic's view, however, has a way of being both right and wrong. This one is certainly correct in pointing out that literacy policies are not formulated and evaluated in a thoroughly rational and comprehensive manner. But it is wrong to demonize the protagonists in these debates. For one thing, the public is not a naive flock of sheep that can be easily hoodwinked into believing that there is a problem, when none really exists. Generally, each individual knows whether he and those around him can use the written word as well as they ought. And few have to be told that the modern means of producing our material necessities and cultural enjoyments depend as much on the information as on the labor and raw materials used in those processes or that the written word is essential for conveying much of that information. Moreover, the protagonists in these debates are about as selfless as any group is likely to be. The onus and the rewards have fallen to reading teachers, not because they were more devious and clever, but merely because the logic of their case was more direct and obvious. The worst that could be said

of either the public or the protagonists is that they hold a rather simplistic view of the nature of literacy. But they can hardly be blamed for that since literacy is produced by a variety of private and government institutions that are related in subtle and complex ways. And no one had yet proposed a comprehensive way in which we could model that program and then formulate and evaluate the policies that govern it.

The purpose of this paper is to present such a model and then to demonstrate its use by showing that achieving and increasing literacy efficiently depends on our maintaining a proper balance among several activities. Particular attention will be given to the balance between reading and writing instruction and to showing that an overemphasis on either leaves us just as poor but a lot less literate then we could have been.

First, we will assure ourselves that there really is a literacy problem and that it is an important one. Next we will examine the definition of literacy on which the model is based. Third, we will develop this model in a way that accounts for the four major determinants of the society's literacy, namely the level of people's reading ability, the comprehensibility or clarity of the materials people read, the number of people who read anything, and the number of materials that each reads. Fourth, we will examine the basic logic for evaluating policies that are formulated using a model of this sort. And, finally, we will explore some of the major consequences of overemphasizing either reading or writing instruction.

Extent and Importance of the Literacy Problem

Introductions to discussions of literacy policy have generally been implausible and probably counterproductive. Good rhetorical form dictates

that they begin by establishing a pressing need to attend to this subject, in particular that people are not as literate as they ought to be and that the situation is taking a fearsome toll. But then the authors, lacking solid evidence on these matters, proceeded to cite evidence that shook his reader's faith, evidence that at best suggested that we do not really know if most people are as literate as they ought to be and, if some are not, whether they are really just a small number of unfortunates for whom literacy is the least of their problems. Hence, only the readers who were already convinced could hold onto their initial beliefs; the intelligent and honestly concerned would have had to be driven to skepticism; and the skeptics made more so. Better evidence is now becoming available, so let me briefly indicate its nature and at the same time try to regain some of our lost credibility by setting the newer evidence in contrast with the old.

Status of Literacy: At least at first glance, the evidence customarily presented on the state of people's literacy does appear alarming. First, in its most recent survey, the Bureau of the Census (1969) found that 1.0 percent, or a total of 1.4 million, of the people over the age of 14 were illiterate in the sense that they could not both read and write simple messages in any language. Next, almost half of the students in the United States score below their grade-level expectancy on reading achievement tests (Allen, 1969). Third, students' scores on these tests seem to have been declining a bit during the past decade (Farr and Tuinman, 1974). And, finally, large numbers of college students do not seem to write as well as some of their professors would like

to have them write (Lyons, 1976).

The use of these statistics has been criticized on a number of points (Powell, 1975 and Bormuth, 1974), the most important being these: The fact that one percent of the adult population is unable to read and write simple messages is hardly alarming in view of the fact that about that many people are also severely impaired neurologically, visually, or intellectually. But we cannot then conclude that nearly everyone realistically capable of achieving literacy is doing so. Illiteracy refers to no useful ability to read and write, while literacy normally implies as much ability as is realistically desirable. Between those two amounts of ability lies a broad gray belt that, for all the census data tell us, may contain all or none of the remaining 99 percent of the population. Nor is it very enlightening to be told that about half of the school children scored below their respective grade-level expectancies, since that is exactly equivalent to saying that half of their scores fell below the average score of students at their grade level and since half would remain below that point even if all were miraculously to become perfectly literate. Next, the fact that student's scores on reading tests may have fallen a bit is only marginally relevant for assessing their literacy, since their literacy also depends on the complexity of the materials they ought to read. For all this statistic tells us, the students may or may not have enough skill to deal with materials that complex. Finally, being told that college students do not write well enough to please their professors

begs the central issue, that is whether those students write well enough to convey the information they should to the people for whom they will ultimately want and need to write. So, whether people are or are not as literate as they ought to be cannot be determined from the evidence most commonly cited on this matter.

Some direct and modestly plausible evidence has become available on the matter. One pair of studies (Bormuth 1968 and Hansen and Hesse 1974) showed that over 30 percent of the high school seniors could obtain little or no information either from the average textbook used in their instruction or the average news article. Another study (Louis Harris and Associates, 1970) found that over 18 percent of the adults in the United States filled incorrectly over 10 percent of the blanks in some forms that were more or less similar to those used for personal identification and for applying for personal loans, driver's licenses, public welfare, and Medicaid. And a fourth study (Stict, 1975) indicated that a substantial number of soldiers cannot obtain much of the information contained in the materials they would have to read in order to perform some fairly common military occupations such as that of a cook and a light weapons infantryman. These studies are especially significant by virtue of the fact that they employed materials that were of practical significance to the people being tested. Thus, they demonstrated not only that many of these readers were illiterate with respect to materials they actually wanted or needed to read but also that the writers of these materials were illiterate

with respect to many of the readers for whom they actually wanted or needed to write. Thus, we can legitimately conclude that many people are not as literate as they ought to be.

Consequences: The evidence commonly cited to demonstrate the significance of the literacy problem has often been less than convincing. It consisted of evidence such as that the inhabitants of our jails are poor readers (Allen, 1969), that those who read the least earn the least and occupy poorer than average housing (Sharon, 1972), and that many poor and elderly people have to have help in filling out their applications for welfare and Medicaid assistance (Louis Harris and Associates, 1970). Now these matters certainly do merit attention of some sort. But they raise serious questions about what kind of attention is required most and whether literacy is of much really fundamental importance. To begin with, did people wind up in jail or poor because they did not learn to read well, or were poor circumstances the result of low intelligence, unwillingness to apply themselves, or location in a destructive social environment? Would these people profit most from increased instruction in literacy skills in view of the army of public employees hired to help people fill out forms, or do they have more pressing needs for which the money should be spent? And finally, these statistics suggest that the literacy problem is entirely confined to a small fraction of the population. Thus, arguments for the significance of the literacy problem have generally boiled down to a plea for massive expenditures to help a pathetic but small number of people attain some skills that they may or may not want or need.

We can begin to estimate the full magnitude of the literacy problem if we examine a survey of adult reading habits conducted in 1971 (Sharon, 1972). It was found that the mean amount of time an adult spent reading was 166 minutes (median = 106 minutes), or 2 hours and 46 minutes per day and one-sixth of his 16 waking hours. Substantial fractions of this reading was done in direct support of work, shopping, traveling, recreation, and virtually every other human activity. The time spent reading at work was especially interesting since I could use this figure to obtain at least a very conservative estimate of the monetary value that is placed on reading and the extent to which reading contributes to our basic material welfare. The mean amount of time that gainfully employed people spent reading on their jobs was 141.1 minutes (median = 61 minutes) or 29.4 percent of an eight hour working day. When we take this fraction of the Nation's total income for that year, which was $859.4 billion, we find that employer's thought that these people's reading activities on their jobs was worth at least $252.6 billion ($347 billion in 1976 dollars) or about one-fourth of the gross national product for 1971. Thus, we can say that at least one-fourth of the value of all the goods and services produced annually is contributed by reading.[2]

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2. This figure barely begins to account for either the costs or benefits of literacy. Consider, as examples, the moneys spent for instruction in literacy skills, libraries, mail and telegraph, services, and printed matter, not to mention the value of the time people spend reading and writing while not gainfully employed.

Now, since one-fourth of our material wealth and large fractions of our other essential needs as well as our wants depend directly on our reading activities, we can conclude that literacy is one of our most extensive and basic activities. And then, since over a third of the students graduating from our high schools can obtain virtually no information from the average textbook, news article, and other materials they need or want to read competently, we can plausibly conclude that we have a literacy problem of almost heroic dimensions. And finally, we can conclude that we ought to be giving very serious attention to how we go about formulating literacy policy.

Nature of Literacy

The first step in developing a model of the literacy program is to decide exactly what it is that that program is supposed to produce, namely literacy. This is by no means a trivial problem since people use that term to refer to a lot of different things and each user tends to be a bit jealous of his own definition. Rather than join the battle for ownership of this word, let us simply stipulate the meaning that is most convenient for our present pruposes and then briefly examine its relationship to the general meaning of the term. For our present purposes we will speak of the volume of literacy and will let that term refer to the total amount of information[3] that people

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3. Information comes in many forms; true and false, good and bad, explicit and implicit, aesthetic and mundane, and so on.

Curriculum workers need to pay close attention to these distinctions since a different kind of skill is required for a person to obtain each kind of information. Those who make the major decisions about literacy policy are interested chiefly in the end product of the literacy program, the information that is exchanged, and are only secondarily concerned with the extremely technical matters dealing with the kinds of mental processes by which people deal with these various kinds of information.

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exchange through the materials they want or need to use.

Direct versus Indirect References: In order to achieve literacy, people must engage in four activities -- learning how to read and write, manufacturing materials, and distributing those materials to their readers. The people who conduct and supervise these activities often use the term literacy to refer to the end product of their particular activity; teachers to refer to the amount of reading or writing skill they impart to a student, publishers to the volume of materials that they manufacture, and librarians and book sellers to the amount of material that people buy or borrow. However, these are merely synecdochic usages of the term, for each is actually a partial determinant of literacy rather than being literacy itself. Other things being equal, each partial determinant would provide a reasonably good indicator of literacy but no single one of them is literacy itself. That is, a person cannot be literate in any meaningful

sense unless he has at least some reading skill, unless someone has achieved at least some writing skill, unless at least some materials have been produced, and unless he can get at least some of those materials. Changing the level of any one of these variables changes the extent of his literacy. Thus, literacy refers directly to the actual exchange of information that takes place when a person reads a material. And the amount of information that is exchanged at that point counts as a direct and simultaneous measure of the literacy of both the reader and the writer who produced that material. Thus, our present definition of literacy refers directly to literacy itself.

Reading-Writing Literacy: For many purposes it is useful to distinguish between people's reading and writing literacy, for these two aspects of literacy require the use of different and somewhat independently learned skills that function differently in the system of activities that produce literacy. However, the level of people's literacy is determined jointly by the two and not by either one by itself. That is, a society could exchange a given amount of information and thereby reach that given level of literacy having only fairly primitive reading skills provided that the writers who prepared the society's materials were highly skilled at their craft. Conversely, people could reach that same level of literacy if their writers were much less skilled provided that they possessed a fairly high level of reading skill. For policy purposes, however, the levels of people's reading and writing skills represent second-order issues. What literacy

is really all about, what we are really seeking and paying for in a literacy program, is that exchange of information. The specific skills needed to get as much literacy as we want is an important but strictly secondary technical issue. Thus, the definition stipulated here makes no distinction between reading and writing literacy since it refers to neither reading nor writing skills but strictly to the amount of information exchanged from writers to readers.

Specific-General: The term literacy can be used to refer to phenomena at any of several levels of generality of either people or materials. It may be used to denote the extent to which a single reader is able to comprehend a single material, some specialized type of material (as is the case with the term functional literacy), or all the different materials he might want or need to read. Similarly it may be used to denote the extent to which a writer is able to communicate information to a single reader, a certain type of readers, or all the readers for whom he wants or needs to write. And finally it may denote the extent to which various groups of readers or writers are able to exchange information using various types of materials. The present definition refers to the extent to which all people in the society are able to exchange information through whatever materials they want or need to use.

Extent-State of Literacy: Literacy may refer either to a variable that ranges from none to much or to a particularly desired level of that variable. We might say, for example, that one reader is more

literate than another with respect to some particular material, meaning that the one obtains more information from that material. This is one use of the extentive sense of the term. Then we might go on to use the term in its stative sense by saying that only one of these readers is literate on that material, meaning that only he could obtain the desired amount of information. Further, when we speak of a person being a literate reader, for example, we generally intend to indicate that he can achieve the state of literacy on all of the materials that he might realistically want or need to read. And speaking of a group or a society being literate generally indicates that all of its members have reached the state of literacy on all of their respective materials. Similarly, saying that a writer is literate generally means that he can elicit the state of literacy in his intended readers on each of the materials he wants or needs to write. And saying that a group or a society has achieved writing literacy, generally indicates that its individual members have all reached this state of writing literacy. The sense of literacy chosen for use in this policy analysis employs the term in its extentive sense.

Volumetric versus Incremental Extent of Literacy: Ordinarily the context in which we use the term literacy makes clear the sense in which the term is intended, except in some uses of the extentive sense. In such cases, it may refer to either of two different measurement operations. On the one hand, it may refer to a measure that increases in lumps, one material at a time. Measuring a person's literacy in this sense would involve testing his comprehension of a material, counting him literate if he answered a criterion number of questions,

and then counting this material and each of the other materials on which he achieved this state as one no matter how far he exceeded this criterion. Similarly a society's literacy would be measured by counting each person simply as literate or not literate regardless of whether he slightly or greatly exceeded the criterion number of materials barely needed to classify him as literate. Thus, in this view, the extent of literacy goes up incrementally in large lumps, one material or person at a time. On the other hand, extentive usages may imply only that we counted the total number of questions a reader answered on a material and then summed these scores across materials and then readers. In this sense, the extent of a person's literacy goes up smoothly in small increments and resembles a measure of the volume of information a person or a society might obtain. In actual practice these two measures would undoubtedly be fairly strictly proportional to each other. However, for present purposes, it is far simpler to use the volumetric sense of the term.

Model of the Literacy Program

Three things need to be said in introducing this model of the literacy program. First, its immediate purpose is to identify the major determinants of society's literacy and to describe how those determinants relate to each other in order to produce literacy and the costs of literacy. This basic model will permit us to evaluate certain broad issues of literacy by casting them into the form customarily employed in economic theory and by invoking familiar and well established principles of economics as we proceed with our analysis. Second, this

model can then be further analyzed and elaborated in as much detail as might be needed in order to study literacy policies having any degree of breadth, ranging from the decisions confronting a classroom teacher, a student, or a writer up through the broad national issues that we will actually address here. However, we will only briefly indicate how these elaborations are performed and, instead, concentrate on the broad issue of why a balance must be struck between reading and writing instruction. Finally, it is presently possible to present the model only in a broad conceptual form. Although it rests entirely on familiar and firmly established scientific principles, we do not yet have available much of the data necessary to estimate all of its parameters. Nevertheless, even when it is cast in this generalized form, it will permit us to discover some useful things to know about the policies that govern the literacy program.

Form of the Model: Given that people have any desire to exchange information through the written word, then the volume of literacy (I) that is produced by its literacy program depends entirely on the level of people's reading ability (A), on the degree of comprehensibility or clarity (C) with which their materials are written, on the number of materials (M) that these people read, and on the number of people (P) who do any amount of reading. Which is to say,

$$I = f (A, C, M, P). \qquad (1)$$

Then the costs (K) of producing that volume of literacy are determined by the same four variables. Hence,

$$K = g (A, C, M, P). \qquad (2)$$

Taken together, equations (1) and (2) assert in very generalized form the central facts of the literacy program and constitute the conceptual basis for further developing the model.

Before we do so, however, we should note two things about the model. First, it accounts for people's writing ability, albeit obliquely. The degree of comprehensibility of a material (C) is determined in part by the level of people's writing skills and in part by the costs having them apply those skills to that material, chiefly the cost of the time required to prepare the material so that it has its level of comprehensibility and the cost of manufacturing a material having the length necessary to reach that level of comprehensibility. Writing and manufacturing costs and level of writing skill required seem to rise in steep exponential fashions as we try to reach very high levels of comprehensibility with a material. Second, the chief scientific issues raised by this model are how we might measure the volume of information a person obtains from a material, the ability of a reader, and the comprehensibility of a material and then whether, other things being equal, the latter two variables fully determine the former. The information a person obtains from a material is fairly reliably indicated by his score on a question test or cloze test made from a material and then the comprehensibility of the material can be measured either directly using people's mean score on this type of test or indirectly using word length, sentence length, and other indicators of the complexity of the language in the material. People's

reading ability can, under most circumstances be measured satisfactorally using a commercial standardized test of reading achievement. As for the extent to which the information people obtain from materials is determined by their reading ability and the complexity of the materials, modern readability studies (Coleman, 1971 and Bormuth, 1966 and 1969) have consistently found that these two types of variables account for virtually all the reliable variance in measures of the extent to which people comprehend materials.

Further Specification of the Model: We can exploit the basic reasoning and scientific facts underlying this model to give it a more definite mathematical form. However, in doing so we will ignore intercept and slope constants, interactions, and nonlinearities partially for the sake of clarity, partially because a couple of them have not yet been determined, and partly because they are not essential for the immediate uses we will be making of the model.

Now, start from the proposition that the amount of information that a particular person (p) is able to obtain from a particular material (m) that he reads is increased with that person's reading ability and with the comprehensibility of that material. Which is to say,

$$I_{p,m} = A_p + C_m . \qquad (1)$$

Then the volume or total amount of information that he can obtain from all the materials (M) that he reads in a given space of time is simply the sum of the amounts of information that he obtained from each particular material in that set. Hence,

$$I_p = \sum^{M} (A_p + C_m) . \qquad (2)$$

And the total volume of society's literacy must be the sum of the amounts of information that each of the people who read anything (P) obtained from the materials they respectively read,

$$I = \sum\sum^{PM} (A_p + C_m) . \qquad (3)$$

Since sumation notations are a bit messey to work with, we will eliminate them by first deriving the expression for the mean volume of society's literacy ($\bar{I}$) by starting from equation (3).

$$\bar{I} = \frac{I}{P \times M} = \frac{\sum\sum^{PM}(A_p + C_m)}{P \times M}$$

$$= \frac{\sum\sum^{PM} A_p}{P \times M} + \frac{\sum\sum^{PM} C_m}{P \times M}$$

$$= \frac{(\sum^{P} A_p) M}{P \times M} + \frac{(\sum^{M} C_m) P}{P \times M}$$

$$= \frac{\sum^{P} A_p}{P} + \frac{\sum^{M} C_m}{M} .$$

Since these last two terms simply represent, respectively, the mean reading ability of people and the mean comprehensibility of the materials they read, we can say that

$$\bar{I} = \bar{A} + \bar{C} , \qquad (4)$$

or, in words, that the volume of the average person's literacy is determined

by the mean level of people's reading ability and the mean level of comprehensibility of their materials. Then it follows that the total volume of society's literacy must be

$$I = PM\bar{I}$$
$$= PM\ (\bar{A} + \bar{C}). \qquad (5)$$

Thus, if we want to look just at the effects of increasing either the mean level of people's reading ability or the mean level of comprehensibility of their materials, we can do so by holding at their current levels the number of people who read something (π) and the number of materials they read (μ) to obtain

$$I_{\pi\mu} = \bar{A} + \bar{C}. \qquad (6)$$

And, finally, by following the same line of reasoning, we could also find that the cost of producing a given level of literacy is given by

$$K_{\pi\mu} = \bar{A} + \bar{C}. \qquad (7)$$

It should be kept in mind, however, that equations (6) and (7) would probably contain very different parameters if they were actually instrumented. In subsequent discussions of literacy policy we will rely primarily on equations (6) and (7) as the expression of the model.

Elaboration of the Model: The basic model given in equations (1) and (2) can be elaborated to fit the problems encountered by various decision makers. A Congressional committee, for example, might regard equations (1) and (2) as sufficiently detailed to comprehend many of the problems it deals with. But a school administrator might want to

analyze the determinants of reading ability in more specific terms. Thus, he might begin by analyzing people's reading ability (A) as being determined by their motivation to read (MR), their aptitude for learning (AL) reading skills, and the quality of their instruction (QI). Which is to say,

$$A = h(MR, AL, QI). \quad (8)$$

And then he might need to further analyze the quality of instruction (QI) as being determined by the extent of teachers' training (ETT), number of audio-visual aids (AVA), the time a teacher can devote to each student (TTS), and so on (ETC.). Thus, he obtains

$$QI = i(ETT, AVA, TTS, ETC.) . \quad (9)$$

Then by substituting equation (9) for the (QI) in equation (8) and equation (8) into equation (1), he might obtain

$$I = j(MR, AL (ETT, AVA, TTS, ETC.,) C, M, P), \quad (10)$$

which would presumably account for every variable that bore on the decision he was trying to reach, either by representing a variable that he could influence by his own policy decisions (e.g. influencing (ETT) by providing inservice training for teachers) or by representing a variable that set limits on the effectiveness of his decisions (e.g. the students' aptitudes for learning reading skills).

Similar analyses may be made of the remaining terms in this equation. Comprehensibility of a material, at the second order of analysis, is determined by the skills of its writer, time expended by the writers and editors of the material, and the length of that material. That is to say, virtually anything that can be written, can be phrased in a very

simple and comprehensible form, provided that we are willing to pay the costs involved in training and employing highly skilled writers for as much time as they need to do their work and in allowing them to extend the material to whatever length may be needed. The number of readers is determined by the size of the population, the need people feel for printed information, and the costs of obtaining that information, the latter being determined in turn by the costs of obtaining and using a material and the costs of achieving enough reading skill to comprehend a material of that level of complexity. The number of materials available to a reader is determined by the size of the reading public, the prices people are willing to pay for materials and the costs involved in producing materials, the latter being determined by the expenses involved in printing and distributing materials and those involved in producing materials sufficiently simple for people having the level of reading skills of the intended readers.

Prescriptive Logic of the Model: We can use equations (6) and (7) to prescribe how we ought to distribute our resources between efforts to influence people's reading ability and efforts to influence the clarity of materials.[4]

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4. Those familiar with microeconomics will recognize the arguments that follow as a standard description of the theory of economic equilibrium (see Stiegler 1966, for example), and those familiar with decision theory will recognize it as linear programming or

operations analysis (see Baumol 1965, for example).

First, notice that these equations both contain two unknowns to the right of the equal signs. Mathematically, that means that we can reach any single level of literacy using various combinations of the variables to the right of the equal signs. Line I_1 in Figure 1, for example, represents the single level of literacy, that could be reached by obtaining various levels of reading ability in people and comprehensibility in materials. Thus, we could reach point M on I_1 by spending the large amount of money needed to raise people's reading ability to point a and then by also spending so little for writing instruction and the preparation of materials that their comprehensibility would sink to point c. Or we could reach point N on I_1 by spending just enough effort to allow people's reading ability to reach point b while investing in the efforts necessary to raise the comprehensibility of materials to point d. In any case, equation (6) clearly asserts that our present policies for funding these two kinds of efforts has put us at some point on an isoliteracy line such as I_1 or I_2.

Insert Figure 1

Next consider the fact that we could increase literacy from level I_1 to level I_2 in several ways. If we were now at point N on I_1, and if we did our usual thing of believing that reading ability was the

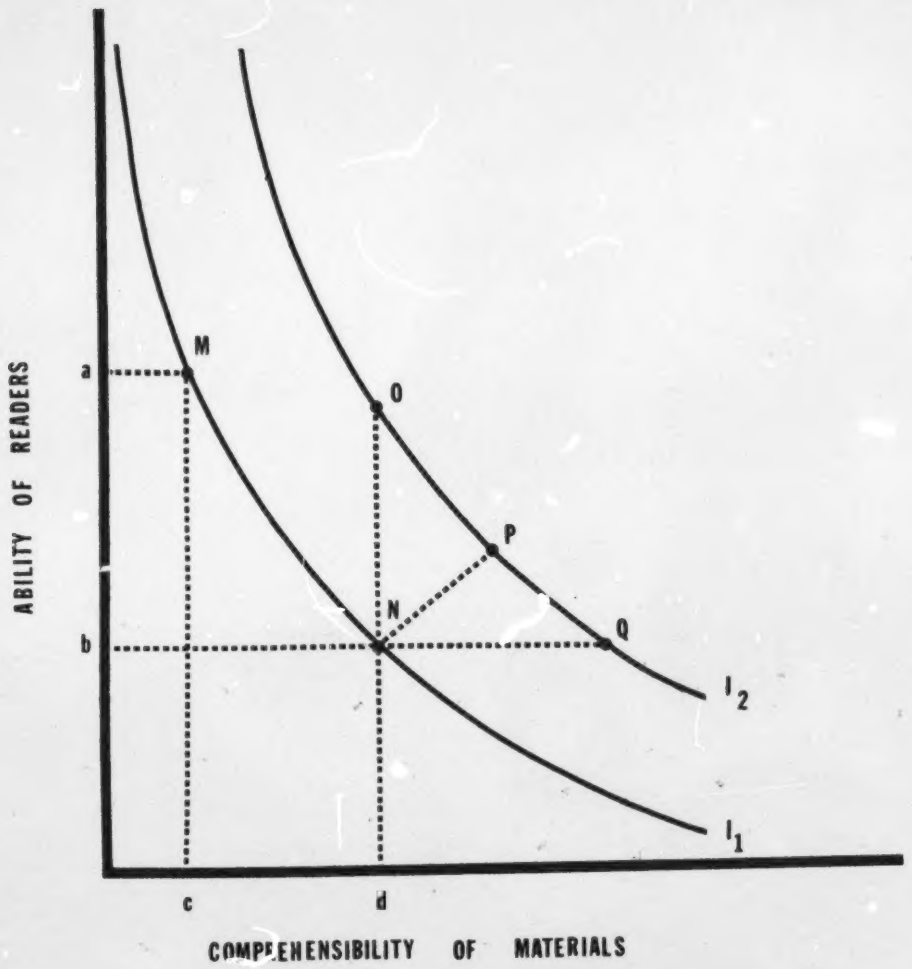

Figure 1 Combinations of levels of reading ability of people and comprehensibility of published materials that produce either level of literacy I_1 or level of literacy I_2.

only important determinant of literacy, we would hold constant (i.e., neglect) our efforts to increase the comprehensibility of materials and increase our efforts to increase people's reading ability. This would put us at point O on I_2. But we could just as well have increased literacy in the opposite way, by holding reading ability constant while increasing the comprehensiblity of materials and thereby hoisted ourselves to point Q where we would be just as literate as we would be at point O. Or we might have chosen a somewhat shorter and probably less expensive path by increasing both efforts simultaneously in a balanced fashion and thus have arrived at point P where we would be just as literate as we would be at either point O or point Q.

Now the question is, would some apportionment of any given budget for literacy yield a higher level of literacy than any other division that we could make of that amount of money. The answer is almost certainly yes, and that apportionment would almost certainly require a balanced apportionment of that budget; some to efforts directed at reading ability, some to efforts directed at clarifying materials and both amounts of effort carefully balanced to give us the most literacy that we could buy for our money.

Consider Figure 2 which shows several of the isoliteracy lines that we might obtain (if we knew the parameters of equation (6)), namely lines I_1, I_2, I_3, and I_4. In addition, it shows an isobudget line such as we might obtain from equation (7) if we knew its parameters, also, and if we set the total cost of our literacy efforts ($K_{\pi\mu}$) equal

to the total amount of money that we had budgeted for literacy and then calculated the various combinations of amounts of reading ability and comprehensibility that we could buy with that amount of money. These combinations would all fall along a single line that is illustrated here by the line extending from A down to C. And that line shows that we could, if we wanted, spend all of our budget for activities designed to impart reading ability while leaving nothing to spend on efforts to make materials more comprehensible. Doing so would put us at point A which would; as might be expected, eventually lead to a very low level of literacy, one that falls well below level I_1. Or we might spend the whole budget just for increasing the comprehensibility and find ourselves at point C which also represents a very low level of literacy. Or, we might balance our allocations to buy any of the combinations of amounts of reading ability and comprehensibility that lie along the line from A to C.

Insert Figure 2 about here

Obviously, we would want to buy the amount of each that would allow us to reach the highest level of literacy we could get for our money, and that would mean putting ourselves at point P where the budget line touches the I_2 level of literacy. Thus we ought to buy a amount of effort to teach reading ability and c amount of effort to clarify materials. And doing anything other than that would only leave us just

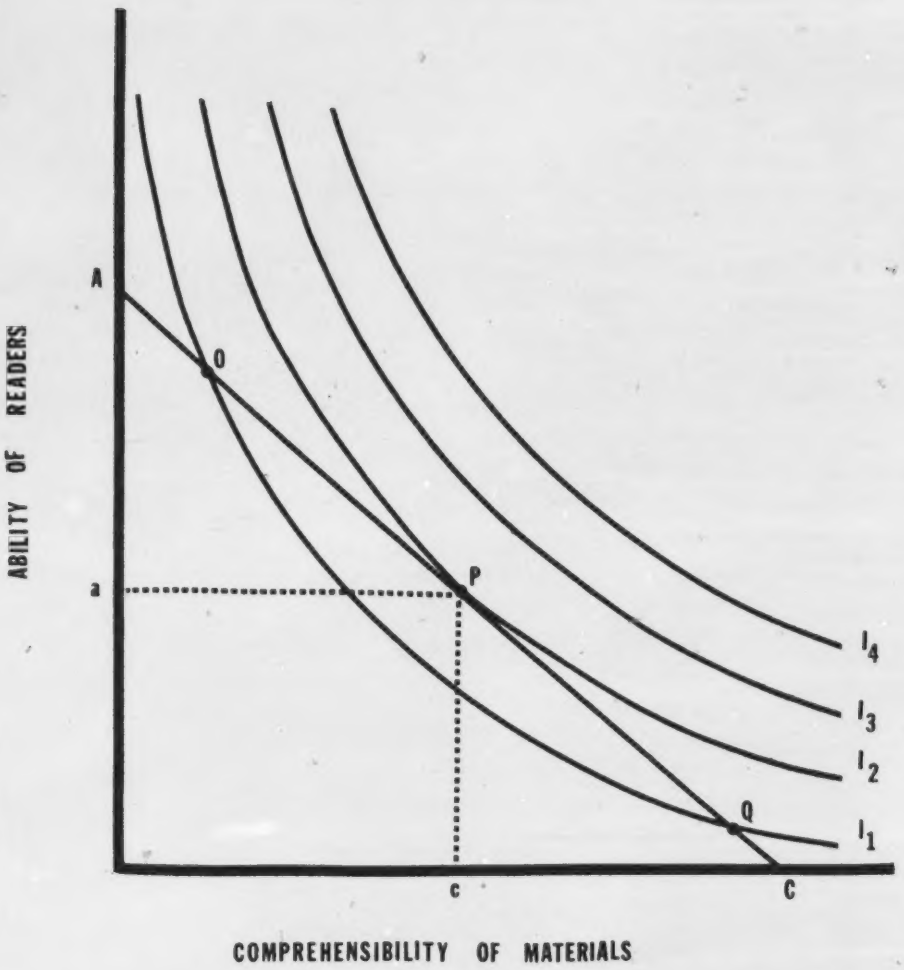

Figure 2. The allocation of resources that would produce the highest level of literacy in return for the resources spent.

as poor, but less literate than we could have been. If we did our usual thing of neglecting the clarity of materials, we might spend more for teaching reading and wind up at point Q where we would reach only the I_1 level of literacy. Or, if we repented these neglectful ways and overreacted, we might cut back reading instruction so that we could greatly extend writing instruction. And that could put us right back on level I_1, this time at point Q. The prescription for policy, then, is clear. We ought to balance our allocations carefully between efforts to teach reading and efforts to insure the clarity of materials. Now, we need to find out what economic forces come to bear on literacy that make this the only sensible prescription for literacy policy-makers to follow.

Vulnerability to Inefficient Allocations: The literacy program is especially vulnerable to the wastes that must result from the inefficient allocation of resources to efforts to produce reading ability and clearly written materials. The problem arises in part from the fact that we have not had a precisely formulated model of the literacy program, in part from the fact that a major portion of the literacy program is conducted by schools which are socialized institutions that are insulated from the disciplining forces of the market place, and in part from the fact that the major adverse consequences of inefficient allocation decisions show up in ways that are fairly subtle and remote from the people who have to decide how to allocate these funds.

To begin with, there would be little reason to question the efficiency of allocations for reading and writing instruction if those services were like ordinary goods and services that are bought and sold in a free and competitive market place. Economic theory and an awesome amount of economic research (Stiegler 1966) assures us that, when people are left to themselves in the free and competitive market, they will tend to maximize the efficiency with which they spend their resources. Which is to say, they would tend to divide their resources between buying reading ability and clearly written materials in proportions that would hover close to point P in Figure 2, where they would be buying about as much literacy as they could buy for the resources that they felt they could spend on the matter. Any departure from that point would be certain to set in motion a train of counteracting events that would turn their buying behavior back toward this point of maximum efficiency.

But reading and writing instruction are not traded in a free and competitive market, primarily because reading and writing skills are much more valuable to society as a whole than to many of the individuals whom we want to learn them. As a result, society has to bear much of the cost of this instruction and has done so through government operated schools. And the officials of those schools are then forced to decide how to balance their appropriations between reading and writing instruction in isolation from the disciplining forces of the market place. That is, the funds and other resources allocated do not belong to those officials;

these officials will not themselves directly benefit from their decisions; and the students who will are in no position at their tender age to even perceive, much less appreicate, the costs and benefits of their instruction.

Nevertheless, school officials could and would avoid unbalanced allocations if they knew when, where, and in what form the consequences would appear. Unfortunately, their view has been blocked by three obstacles. Possibly the least of these is the fact that we have yet to develop an appropriate measure of people's literacy. A more difficult one is the lag of almost a generation between the time these allocation decisions are made and the time when the beneficiaries, or the victims, of these decisions enter adult society and the relative levels of their reading and writing skills can have a significant impact on the other components of the literacy program, particularly on the publishing industry. And finally, if these decisions resulted in an imbalance of reading and writing skills, the impact these young adults would have will be deceptive. Initially, it would appear that society's literacy was rising. But the unbalanced supply of reading and writing skills in society would have already set in motion a train of counteracting forces that would eventually cancel much of the rise initially observed.

Figure 3 illustrates the kind of consequences that would ensue from increasing allocations for reading instruction without counterbalancing efforts to improve the comprehensibility of materials. Suppose

that people's personal budget for literacy results in the isobudget line A to C and that they generally allocate their personal expenditures of effort and money to obtain, on average, a amount of reading ability and c amount of comprehensibility of materials. Then suppose that educational policy makers increased public expenditures for literacy, putting all the increase into improved reading instruction. This probably would not have much effect on the total amount people spent personally on literacy since they would not personally have to pay the bill in a direct fashion.

Insert Figure 3 about here

Rather, it would appear to them that reading ability had suddenly become cheaper. Thus, their budget line would tilt to run from A' to C. The effects would be as shown. The volume of literacy would rise from I_3 to I_4 as their reading ability rose from a to a'. But people would then compensate by personally spending less to obtain comprehensible materials and the average comprehensibility of materials being published would drop from c to c', cancelling much of the anticipated increase in literacy that would have been obtained had the policy makers properly balanced their allocations between reading instruction and efforts to increase the comprehensibility of materials. The same type of waste would have occurred, also, had the policy makers made the reverse error of putting all the increase into efforts to improve the comprehensibility of materials, only this time people would have neglected their reading abilities as the comprehensibility of materials rose. Let us then examine the economic mechanisms that produce these rather distinctly unpleasant results.

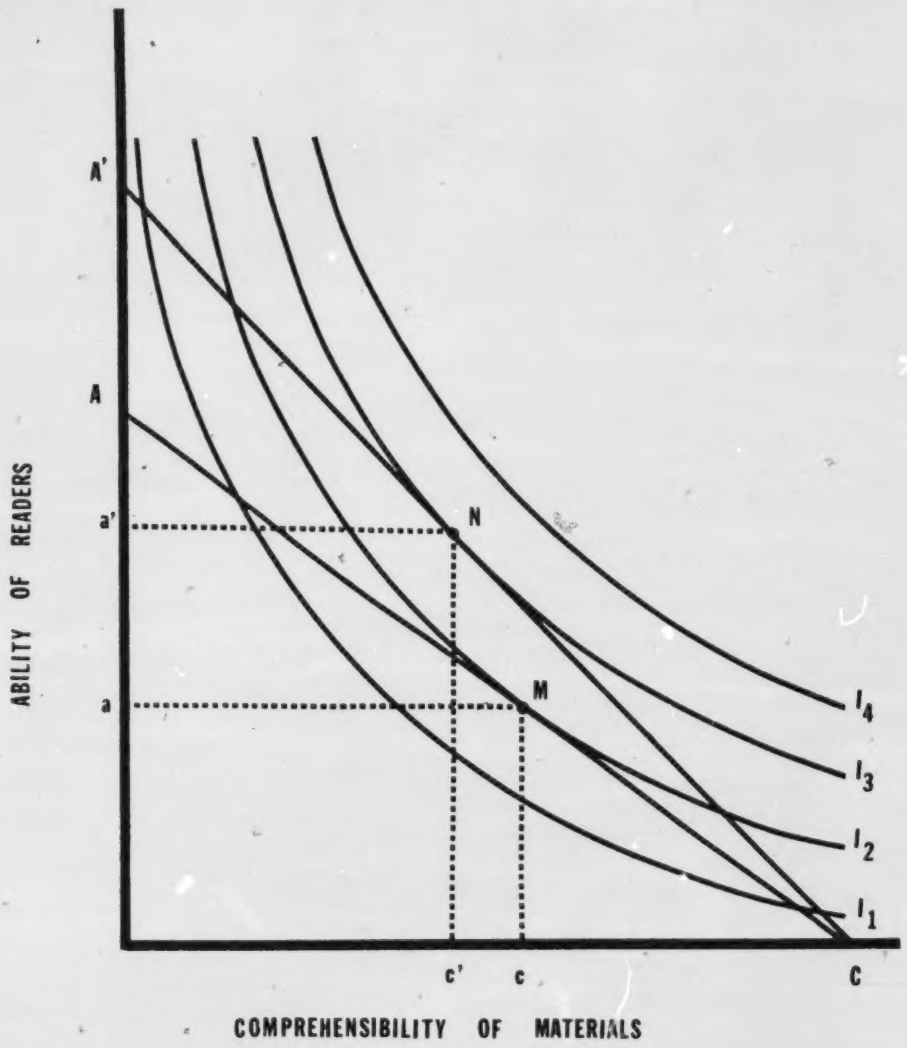

Figure 3. The decrease in the comprehensibility of published materials that would cancel some of the anticipated rise in literacy if allocations for reading instruction were increased without also increasing allocations for writing instruction.

Overspending for Reading Ability: Spending more money and other resources for reading instruction could generally be expected to increase students' reading abilities and that, in turn, would eventually increase the average reading ability in society. Equation 5 then shows that this rise would increase the sum of the average ability of people and the average comprehensibility of materials, and that sum would then be multiplied by the total number of materials read and by the total number of people. Moreover, the rise in average reading ability would no doubt increase the number of readers and the amount of materials that were being read, increasing literacy still more. Hence, the immediate and patently obvious effect of increasing expenditures for reading ability would be a large increase to the volume of literacy. Unfortunately, much of this increase is likely to be only temporary.

To understand why, consider the fact that publishing is a highly competitive industry in which the prices of published materials are essentially beyond the publisher's power to

control, being determined by the market. The only way a publisher can make enough profit to stay in business is by holding the costs of producing a material somewhat below the price it will fetch and then selling as many copies as possible. An important way to reduce its costs is to cut its length and thereby trim his writing, editing, printing, and shipping costs.[5]

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5. The notion that publishers routinely manipulate brevity and comprehensibility of materials is a commonly known but rarely discussed phenomenon. It is a familiar fact that newspapers competing in the same city are able to carve out and hold their place in their market by identifying readers having a certain range of educational levels, catering to their tastes for news, and carefully trimming their writing to suit people having reading abilities in this range. Next, Flesch (1948) showed that limited circulation magazines on intellectual content are written in relatively complex language while popular magazines are written in fairly simple language, and the pulp magazines are written in the simplest language he observed. Third, the average length of the sentence declined by about 50 percent between Chaucer's and Milton's time and the present century (Sherman 1888), a period during which the costs of printing, paper, and ink were dropping dramatically, making it possible for publishers to greatly increase their profits by lowering prices of materials and selling more copies, provided that they also increased the comprehen-

sibility of the language with which those materials were written. Finally, it will come as no surprise to most that the scholarly journals, whose subscribers are among the best readers in society, are written in the most complex language.

He cannot, of course, cut much information from it since that is what people are really buying. But he can and (as every writer knows) does require his authors and editors to say what they have to say as briefly as is reasonably possible in order to save manufacturing costs and in order to insure that he makes at least some profit.

However, deciding how much brevity is reasonably possible is a bit complicated, for the ordinary writer and editor will have to achieve it by sacrificing a certain amount of comprehensibility by resorting to abstract and technical words compacted into complex sentences set in a context stripped of topic sentences and other aids to comprehension. The ensuing loss of comprehensibility can then make this material incomprehensible and unsalable to some who would otherwise have bought it. So, by overemphasizing brevity, the publisher could cut his profits more by losing sales than he would gain by enforcing brevity. A rational publisher will then try to maximize his profits by setting his brevity standards at the point where savings on manufacturing costs exactly equal his losses suffered from decreased sales of copies.

Now the effect of increasing only people's reading ability would be to throw the publisher's brevity practices out of balance. He will immediately, of

course, start selling copies of his materials to a larger fraction of the population and both his profits and society's literacy will rise. But at the same time, the loss of sales that his brevity standard had been causing him to suffer will decline. This will make it profitable for him once again to reduce his manufacturing costs by further tightening his brevity standards. And he will be forced to do so when he wants to or not. If he resists, competing publishers will tighten their standards anyway, reduce the costs of manufacturing their materials, lower the prices of their materials that compete with his, and force him either to tighten his brevity standards also or go out of business. In general it will be true that the greater the increase in people's reading ability, the greater will be the increase in the complexity of materials and the waste of resources. Moreover, none of the publishers who help to put this vicious spiral in motion can be morally impuned for the results, for it can be shown that those results actually make the best of a bad situation and actually maximize society's overall welfare as well as could be done in the face of an inherently wasteful literacy policy.

A very foolish, but unfortunately familiar, way to try to forestall a spiral effect of this kind would be to demonize publishers, charge that their greed for profit had forced up comprehensibility, and thereby gain popular support for imposing government restrictions on the comprehensibility of the materials published. Since we have most of the technical tools required to enforce such regulations, we might be tempted to try. But we would not like the results. To begin with, most ordinary writers using present writing techniques can pro-

duce highly comprehensible manuscript only at great expense in money and time for field testing and trial revisions of manuscript. And we have only a tiny number of the kind of highly gifted writers who can consistently and efficiently produce comprehensible manuscript without resorting to these expensive measures. Therefore, the major immediate effects might include some increase in the comprehensibility of publications, but it would also include increases in the costs of materials, costs that would drive the purchase of many materials beyond the reach of many people, force many publishers out of business, reduce the quantity of materials being read, and thereby reduce the volume of society's literacy. Then in the longer run, people would notice that they had fewer materials to read and that those materials required fewer reading skills than the schools were teaching. Those with a long memory know the rest of this story, for when colleges and professional schools no longer required latin for admission, public support for latin instruction melted away until little or none is taught in either high school or college. While reading instruction would not disappear, the amount of it would almost certainly diminish, average reading ability would plunge downward, society's literacy would take another large drop, and we would wind up a lot poorer and a lot less literate than we could have been had we pursued a more sensible literacy policy.

Overspending for Writing Instruction: If we went overboard in the opposite direction and stressed writing instruction while neglecting reading instruction, the initial effect would again appear to be pleasing.

As the supply of highly skilled writers increased, a publisher could enhance his profits by employing the writers to work on even routine publications where they would meet his brevity standards more easily and economically than present writers and at the same time produce somewhat more comprehensible materials. One immediate effect, then, would be to lower the publisher's costs of manufacturing materials and the competitive forces of the market places would quickly translate his reduced manufacturing costs into lower prices for his materials. Taken together, the lower prices and increased comprehensibility of the materials reaching print would produce a fairly immediate increase in the volume of society's literacy.

However, almost immediately a set of counteracting forces would be set in motion. To begin with, the publisher could be expected to notice very soon that the savings he enjoyed from enforcing his brevity standards were no longer as great because those standards were being met more efficiently. Hence he would profit by tightening them until the declining comprehensibility of his materials once again lost him enough sales to offset the advantages of any further tightening of those brevity standards. This would cancel some of the initial increase of literacy but would probably leave literacy quite a bit greater than before. The major reaction would begin when many adults discovered that materials were so comprehensible that they no longer needed much of the reading ability they had acquired in school. Thereupon, support for reading instruction would decline, the quantity and quality of that instruction would diminish, and

average reading ability (and hence literacy) would commence a spiral downward in pursuit of the declining complexity of materials. If we did not react by again overemphasizing writing skills we would probably wind up with a bit more literacy than we had before, but not with nearly as much as we could have gotten in return for the resources we had spent on the matter.

Effects of Balance Emphasis: These spiral effects could be avoided by taking some of the increased resources allocated for reading instruction and redirecting them instead to the kinds of efforts that would increase the comprehensibility of materials. These efforts could include anything that would lower the publisher's costs of doing business, including increasing subsidies for second and fourth class mail, initiating government support for research and development of more economical means of printing and paper making, and even providing subsidies to cover publisher's janitorial costs. However, these measures would not be equally cost-effective. One of the most efficient means would no doubt be to reduce the publisher's costs of obtaining highly comprehensible manuscript. This could be accomplished by increasing the supply of highly skilled writers and the efficiency with which these writers produced comprehensible manuscript. Hence, this would entail increased research and development for more effective means of teaching written composition and an increased quantity and quality of composition instruction at all levels of education. The effect of these actions would then be to make strict brevity standards much less profitable to the publisher, allow him either to relax or at least hold the line on those standards, and thus to meet rising reading abilities with materials of stable or even declining complexity. In either

case more people would buy and use more materials, and exchange more information through that use. In other words, we would get much more literacy in return for the price we had paid for it.

Conclusion: Literacy is an activity of great cultural, social, and economic importance that consists in the exchange of information from one person to another through the medium of written or printed materials. The industry that produces it can be divided into three components -- one that teaches people reading and writing skills, one that produces the materials that people read and write, and one that distributes those materials to their consumers. Literacy itself then occurs when information is transferred from writers to readers via the materials, and society generally wants to maximize the volume of information exchanged in return for the resources it allocates for this matter.

Most of the components of the literacy program are lodged primarily in the private sector of the economy where we can generally count on ordinary economic forces to insure that literacy is being produced efficiently. Instruction in literacy skills, however, is lodged primarily in schools which are socialized institutions that are insulated from the conditions of supply and demand that discipline the private sector of the economy. And those schools are particularly liable to distort the economics of literacy by virtue of their insulation and the fact that most people have an unbalanced view of the relative importance of reading and writing skills. Whenever they think of literacy they tend to think first, and often exclusively, of reading skills. And when they want to

improve society's literacy, they are generally willing to allocate the added resources primarily and even exclusively for improving reading instruction.

Knowledge of our own biases in favor of reading instruction and a little economic theory strongly suggest that we are wasting substantial amounts of the resources we are spending for literacy. When schools decide on a course of action, they are likely to increase the supply of reading skills relative to writing skills without due regard for which type of skill would, if increased, result in the greatest increase in literacy for the resources being spent. People will consume greater amounts of the skill taught just as if it had suddenly become cheaper, for most of the costs of that instruction will be hidden by distributing them thinly over the rest of the economy in the form of taxes. But the private sector of the economy is forced to respond not only to anticipated benefits but also to its actual costs. The result is that the private sector would be forced to react to an unbalanced increase in reading ability, increase the complexity of materials, and cancel much of the anticipated rise in literacy. Conversely it would react to an unbalanced increase in the supply of highly skilled writers with a slight decrease in the complexity of materials and with a fairly large decrease in society's average reading ability. And, again literacy would not rise by the anticipated amount.

The only efficient course of action for the schools to take is to pursue a balanced program of support for both reading and writing instruction, a balance arrived at by considering both the costs and the

benefits of reading and writing when they are viewed in full context with the rest of the literacy program.

Unfortunately, we presently lack some key pieces of data necessary to determine just how instruction in these two skills should be balanced. But we know that we tend to neglect writing instruction and that we can greatly increase the supply of highly skilled writers by training just a few thousand people but that we can increase the supply of skilled readers only by training millions of people. So we can strongly suspect that we could presently get a lot more literacy for our efforts by spending more on writing instruction. But we will not be able to solve this problem definitely until we have done a considerable amount of research. However, if it is true that a problem is half solved when we realize that we have it and nine-tenths solved when we phrase it in the proper manner, then perhaps we have now covered some of the distance to the solution to this one.

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